Management Recommendations for

Leptogium rivale Tuck.

version 2.0

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SUMMARY

Species: *Leptogium rivale* Tuck.
Taxonomic Group: Lichens (Aquatic)
ROD Components: 1,3
Other Management Status: None

Range: *Leptogium rivale* is known from only 14 sites in the range of the Northwest Forest Plan, seven in Washington and seven in Oregon. All sites are on National Forest lands except the Fidalgo Island site, which is of unknown ownership. In Washington, six sites are on the Gifford Pinchot National Forest, and one on Fidalgo Island. In Oregon, the species is found on the Willamette and Mount Hood National Forests. *Leptogium rivale* is endemic to western North America, known from California, Oregon, Washington, Alaska, Wyoming, Montana, and northern Colorado.

Specific Habitat: This aquatic lichen is primarily found on rocks submerged in water or in the splash or inundation zone of small-order, clear mountain streams, and in a coastal freshwater seep.

Threats: The major threats to *L. rivale* are loss of populations resulting from activities that harm the population or affect its habitat, including impacts from upstream sites. Altering stream conditions such as water quality, chemistry, temperature, light regime, level, opacity, or sediment levels, or changing microclimatic conditions in the associated riparian vegetation are all potential threats. Road building and decommissioning (including culvert placement and removal), restoration activities, and fish habitat enhancement projects involving instream structures are also potential threats.

Management Recommendations:

- Because dispersal may be limited between streams, maintain *L. rivale* in each stream where it occurs.
- Maintain stream quality necessary for survival of *L. rivale*.
- Maintain riparian canopy conditions necessary for survival of *L. rivale*.

Information Needs:

- Determine if the species meets the criteria for being closely associated with late-successional/old-growth forests.
- Verify current status of known populations.
- Determine the stream conditions necessary for survival of *L. rivale*.
- Determine if individuals in stream represent more than one local population.
- Determine the natural range of riparian canopy conditions necessary for survival.

Management Recommendations for *Leptogium rivale*

I. NATURAL HISTORY

A. Taxonomy and Nomenclature

Leptogium rivale Tuck. was described in 1877 (Proc. Am. Acad. 12:170).

Synonym: *Polychidium rivale* (Tuck.) Fink *n. comb.* (Fink 1935).

B. Species Description

1. Morphology

Leptogium rivale is an small, appressed, foliose gelatinous aquatic lichen (Figure 1). The lobes are more or less flat with somewhat raised tips; apothecia are occasional with brownish black discs and thalline rims. At first glance, the species looks like a circular black crustose lichen, and could be confused with *Verrucaria* or *Staurothele*. These two genera are truly crustose; examination with a hand lens would reveal the minute foliose lobes in *L. rivale*. The thallus is lead gray or greenish-gray to blackish. Older thalli occasionally become lobulate. This lichen can be very hard to see.

Technical Description: Thallus 0.5-2.0 cm broad, flat, spreading, tightly appressed with margins occasionally ascending, lead gray or greenish gray to blackish; lobes elongate, the rounded apices 0.2-1.5 mm broad, the margins entire to somewhat irregularly lobulate; surface of thallus smooth, shiny or dull; isidia not present; attached to the substrate by numerous black hairs on the lower surface. Thallus 45-150 μm thick; cortex of irregularly isodiametric cells 3-9 μm in diameter, commonly brownish or blackish, cells of the lower cortex slightly larger than those of the upper cortex; thallus paraplectenchymatous throughout. Photobiont is *Nostoc*; these cyanobacterial cells are 2-4 μm in diameter, spherical, and in short chains throughout the thallus but not abundant. Apothecia not common, adnate on the upper surface of the thallus, 0.2-0.4 mm broad; disc concave, brownish to blackish (Sierk 1964:272).

2. Reproductive Biology

Leptogium rivale reproduces sexually by production of fungal spores in apothecia. Because the species is aquatic, the spores are probably distributed primarily by flowing water. Aquatic invertebrates that graze on this lichen and ingest spores could also be dispersal vectors, as could the downstream movement of colonized rocks. Isidia and soredia are unknown, although some older thalli do produce lobules that may drift to new sites and reattach to rocks.

3. Ecological Roles

Little is known about the ecological roles of this freshwater species. It fixes nitrogen and

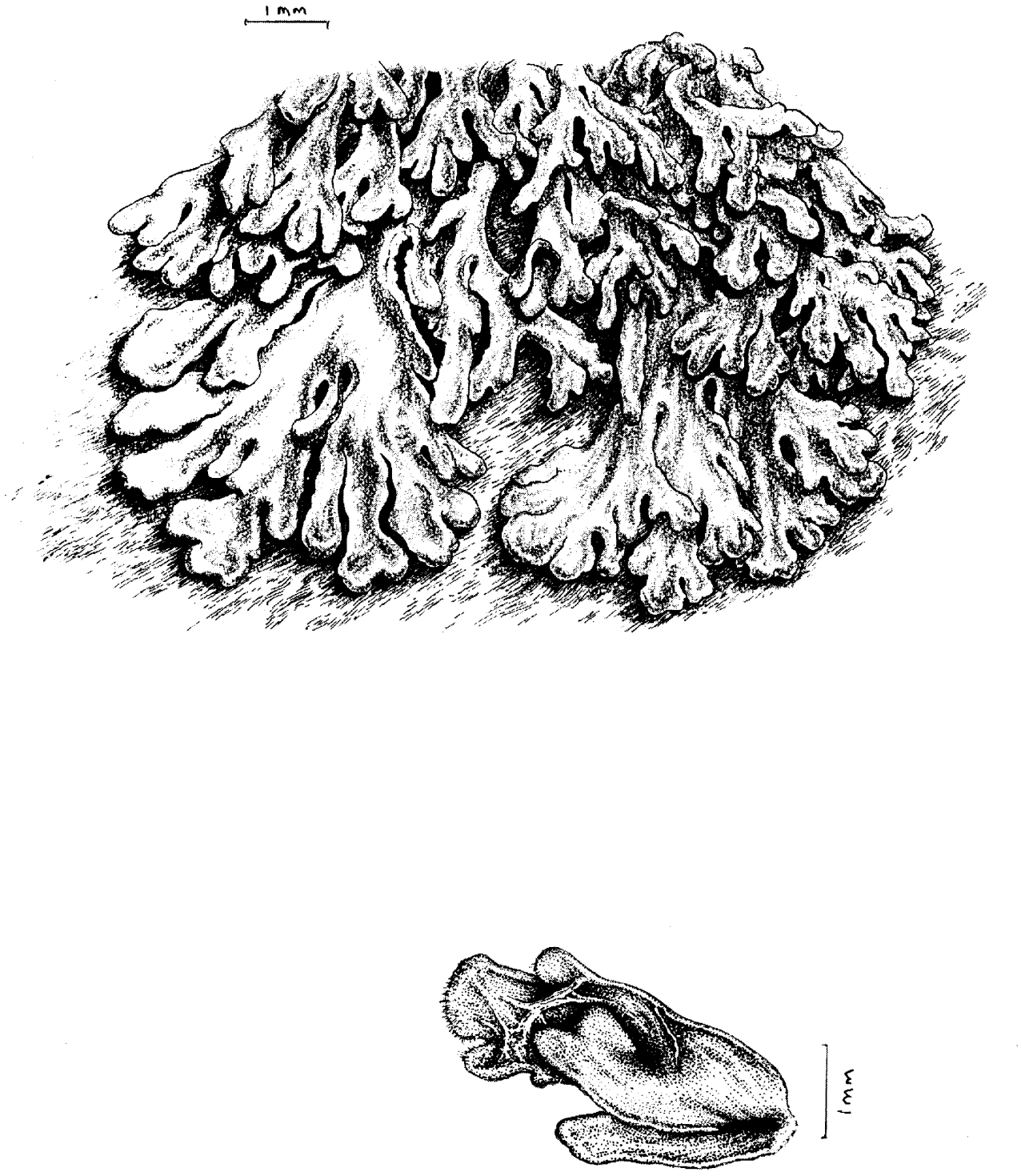

Figure 1. Line drawing of *Leptogium rivale* by Alexander Mikulin.

contributes an unknown amount to aquatic ecosystems. *Leptogium rivale* probably provides forage and cover for some aquatic invertebrates, which in turn are food for fish. Many invertebrates, including protozoans, nematodes, rotifers and tardigrades, use aquatic lichens as food and habitat (Gerson and Seaward 1977). *Hydrothyria venosa*, another nitrogen-fixing aquatic lichen, is often present at sites with *L. rivale*. Aquatic lichens may be good indicators of water quality (USDA and USDI 1994b.).

C. Range and Known Sites

Leptogium rivale is known from only 14 sites in the range of the Northwest Forest Plan, seven each in Washington and Oregon. All sites are on National Forest lands except the site on Fidalgo Island, which is of unknown ownership. In Washington, *L. rivale* is known from the Gifford Pinchot National Forest on McKinley, Snagtooth, and Platnum Creeks, an unnamed tributary on the 2588 road, and from Government Mineral Springs (Skamania County). In Oregon, it is known from the Willamette National Forest near Opal Creek, near North Santiam River, and from the H.J. Andrews Experimental Forest (Marion and Lane counties), and Mt. Hood National Forest near Skipper Creek and the trail to Tamanawas Falls (Hood River County). *Leptogium rivale* is endemic to western North America (Sierk 1964), known from California, Oregon, Washington, Alaska, Wyoming, Montana, and northern Colorado. Although it has been found at one site in southeast Alaska (Geiser *et al.* 1998), it is not yet known from British Columbia (Goward *et al.* 1994).

D. Habitat Characteristics and Species Abundance

In the range of the Northwest Forest Plan, *L. rivale* is found in mid-elevation streams between 105 and 1980 m (1000-6500 ft) on rocks, boulders, and bedrock in streams, rivers, or seeps, usually submerged or inundated for most of the year. In larger rivers with higher flows, it grows on the sides and downstream edges of in-stream bedrock, where it apparently receives some protection from the direct force of the water. It is also reported from a coastal freshwater seep. *Leptogium rivale* can be locally abundant, although its distribution in the range of the Northwest Forest Plan is scattered and the species is apparently rare. This small, black, closely appressed lichen, which looks like black splotches on rocks, can be very hard to see, which could contribute to our limited sites for the species. The lack of records in our area could be because it is inconspicuous and may have been confused with *Verrucaria* or *Staurothele*, and/or it has been under-collected.

II. CURRENT SPECIES SITUATION

A. Why Species Is Listed Under Survey and Manage Standard and Guideline

Leptogium rivale was considered at risk under the Northwest Forest Plan because of its rarity and limited distribution in the range of the northern spotted owl (USDA and USDI 1994a,b). At the time of the FEMAT viability rating, it was only known from two sites in the range of the northern spotted owl (USDA and USDI 1994b).

B. Major Habitat and Viability Considerations

The major viability consideration for *L. rivale* is loss of populations resulting from management activities that harm the populations or impact their habitat.

C. Threats to the Species

Threats to *L. rivale* are those actions that alter stream conditions, including water quality, including chemistry, temperature, light regime, level, opacity, sediment loading and streambank stability, or alter microclimatic conditions associated with riparian vegetation. Building and decommissioning roads (including culvert placement and removal) and restoration activities also pose a threat when they degrade colonized stream segments, or produce sediments that harm downstream populations. Run-off of fertilizers could also threaten some populations. Aquatic ecosystems are particularly responsive to chemical stress because pollutants tend to be well-distributed throughout zones of active mixing (Ford 1989).

D. Distribution Relative to Land Allocations

All known sites of *L. rivale* on federal lands are in Riparian Reserves (USDA and USDI 1994c). The adjacent land allocations need to be determined.

III. MANAGEMENT GOAL AND OBJECTIVES

A. Management Goal for the Species

The goal for managing *Leptogium rivale* is to assist in maintaining species viability.

B. Objectives

Manage known sites on federal lands by maintaining habitat, stream conditions, riparian forest structure and associated microclimate, as well as occupied and potentially suitable substrate.

The objective of management for *Leptogium rivale* is to maintain population viability at each known site.

IV. HABITAT MANAGEMENT

A. Lessons from History

No specific lessons from history about *L. rivale* are known.

B. Identifying Habitat Areas for Management

All known sites of *L. rivale* on federal land in the range of the Northwest Forest Plan are identified as habitat areas where these management recommendations should be implemented. A habitat area is identified as suitable habitat occupied by or adjacent to a known site.

C. Managing in Habitat Areas

Although *L. rivale* is restricted in its distribution, there may be certain areas where it is locally common. If a population of *L. rivale* occurs in a project area, several factors should be evaluated before proceeding with actions that could adversely impact the local population. Evaluate the importance of that population in relation to other known sites. Consider the landscape and ecological context of the population, factors such as the population location in relation to other known populations, relative isolation of the population, ecological conditions at the site and how they compare to other known sites (typical or atypical), areal extent of the population and abundance of the lichen in the local population, and availability of potentially suitable habitat in the area.

Each local population should be maintained intact, however it may be acceptable to impact a small percentage of known individuals at a particular site if it has only minimal impact to the integrity of the local population. Special consideration should be given to populations near the edge of range of *L. rivale*, in watersheds where it is rare and of limited distribution.

After evaluating these considerations, and if a decision has been made to impact the local population in a project area, apply the following mitigation measures. Visit the site with a project coordinator to determine if proposed actions can be shifted upstream or downstream so large concentrations of individuals are not impacted. If impacts are unavoidable, determine if any of the colonized rocks are small enough to be transplanted to suitable habitat above the project area. Transplant as many colonized rocks as possible, and monitor their vigor (Derr 1998).

- Because there may be dispersal limitation between streams, maintain *L. rivale* in each stream where it occurs.
- Determine the extent of local population with a site visit.
- Maintain habitat for the species at known sites on federal lands by maintaining stream conditions including water quality, chemistry, temperature, level, opacity, or sediment loading and streambank stability, and maintaining microclimatic conditions (e.g., light regime) associated with riparian vegetation.
- Reduce sedimentation into populated streams by minimizing or eliminating impacts of road building, maintenance, and decommissioning (including culvert placement and removal) and restoration activities.
- Evaluate upstream activities that could affect downstream populations.
- Evaluate effects from treatments to riparian vegetation and the potential for altered bank stability, sediment and nutrient input, and how known sites of *L. rivale* could be affected by those activities.

- Avoid the use of fertilizers and herbicides near populated streams, including upstream reaches.

D. Other Management Issues and Considerations

Leptogium rivale provides habitat for aquatic invertebrates (USDA and USDI 1994a). Declines in populations could impair ecological functions important to fish and other components of aquatic and terrestrial ecosystems. *Leptogium rivale* fixes nitrogen and contributes an unknown amount of nitrogen to aquatic ecosystems; removing a population could have unknown effects on the nutrient cycles of the stream. The species is thought to be an indicator of water quality (USDA and USDI 1994b) and may be sensitive to changes in water chemistry, temperature, light regime, level, opacity, or sediment load. Known sites should be evaluated at the subbasin scale because activities far from the population may adversely affect the population if they alter upper reaches of an occupied stream. If populations of *L. rivale* are in a project area, evaluate its distribution and abundance in that stream. Because dispersal may be limited between streams, it is important to maintain *L. rivale* in each stream where it occurs. If the species is well distributed in the stream above a project area, evaluate suitable habitat below the project area, and the likelihood that *L. rivale* will be able to repopulate areas impacted during projects. The highest priority should be given to those populations where management activities may alter stream hydrology or aquatic conditions.

V. RESEARCH, INVENTORY, AND MONITORING NEEDS

The objective of this section is to identify opportunities to acquire additional information which could contribute to more effective species management. The content of this section has not been prioritized or reviewed as to how important the particular items are for species management. The inventory, research, and monitoring identified below are not required. These recommendations should be addressed by a regional coordinating body.

A. Data Gaps and Information Needs

- Revisit known sites to verify the status of known populations, determine the extent of the populations and abundance, and characterize ecological conditions.
- Determine if the species meets the criteria for being closely associated with late-successional/old-growth forests.
- Determine the natural range of riparian canopy conditions necessary for survival of *L. rivale*.

B. Research Questions

- What are the dispersal rates, distances, and mechanisms of *L. rivale*?
- Which habitat characteristics and ecological conditions are necessary for establishment of propagules and survival of established thalli?

- In colonized streams, how does cover of *L. rivale* fluctuate seasonally, annually, or between flood events?
- Can *L. rivale* survive transplanting of colonized rocks to different parts of the parent stream and to different streams?
- How should populations be distributed in a stream to optimize recolonization into lower stream reaches?
- How do *L. rivale* and aquatic insects interact?
- What is the ecological role of *L. rivale* in aquatic and adjacent terrestrial ecosystems?
- Do refugial populations colonize lower stream reaches?

C. Monitoring Needs and Recommendations

- Monitor populations at sites of restoration activities, road building and decommissioning (including culvert removal or placement).
- Monitor transplanted populations for changes in cover, biomass, and vigor.
- Monitor streams for dispersal of *L. rivale* where it has been reintroduced.

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